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Online databases: WPI

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(54) Toy car

(57) A toy car is provided which can manoeuvre around obstacles while running along a surface. The toy car, which runs forward by forward rotation of a motor (11), has switches (6, 9) operable when the car collides with the obstacle, a controller (19) for driving the motor (11) to rotate in the reverse direction for a predetermined time by the action of the switches (6, 9), and steering mechanisms (26, 28) for steering the toy car to run straight when it advances and to turn when it goes back. The switches (6, 9) suitably take the form of a bumper vertically rotatable when the car collides with an obstacle, and a switch abutting the bumper and operated by rotation of the bumper.

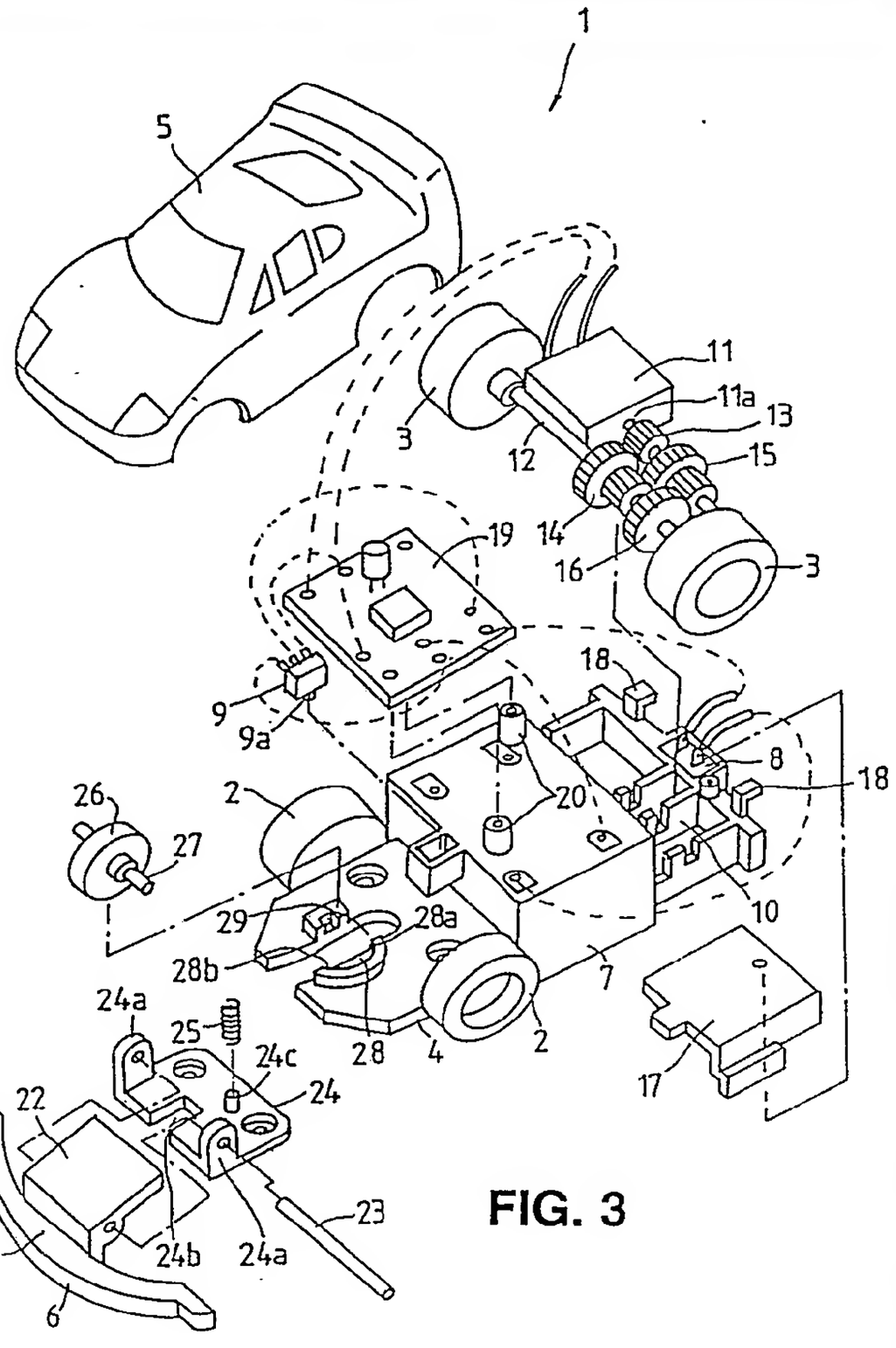

FIG. 3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 266 060 A

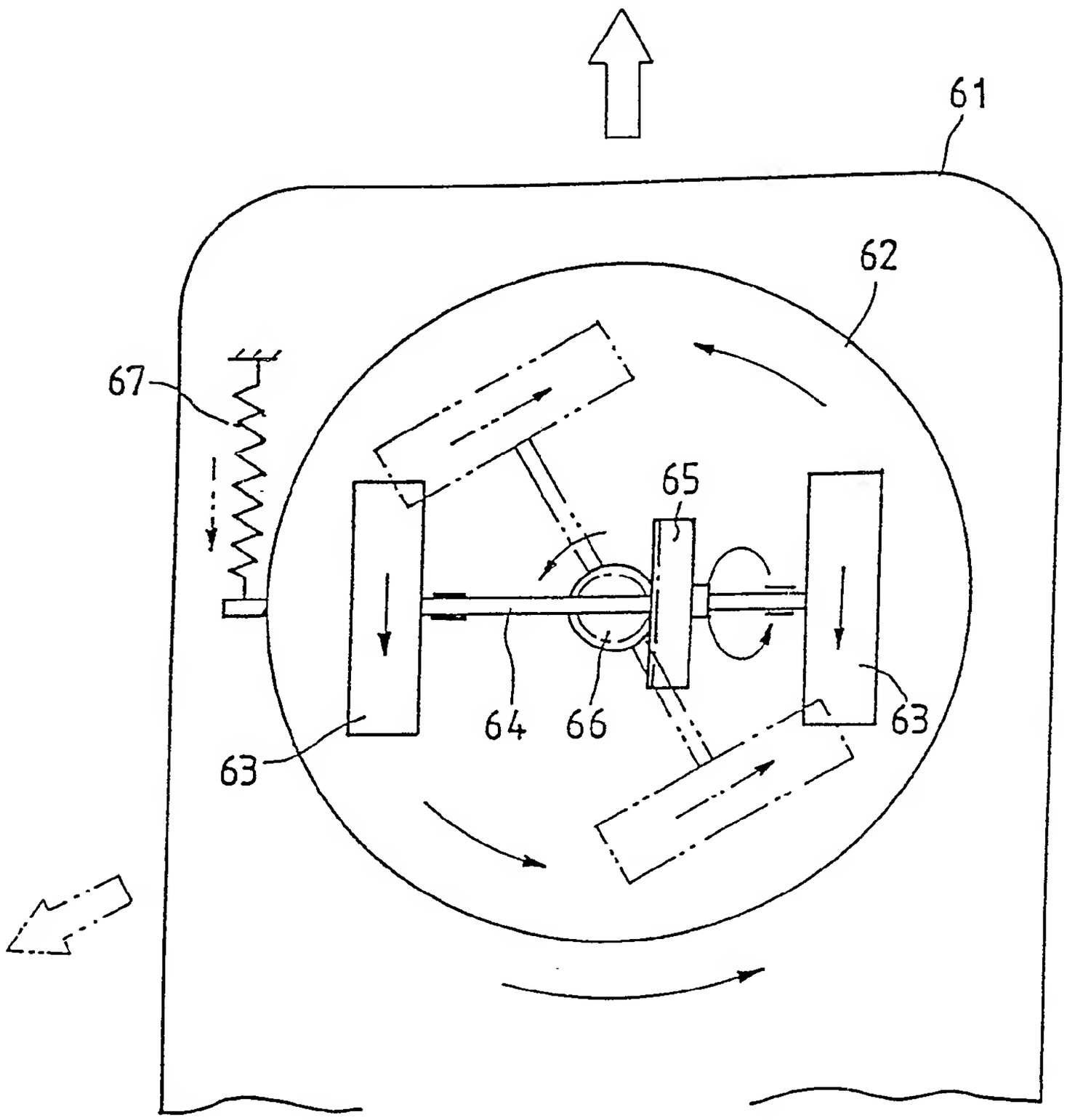

FIG. 1

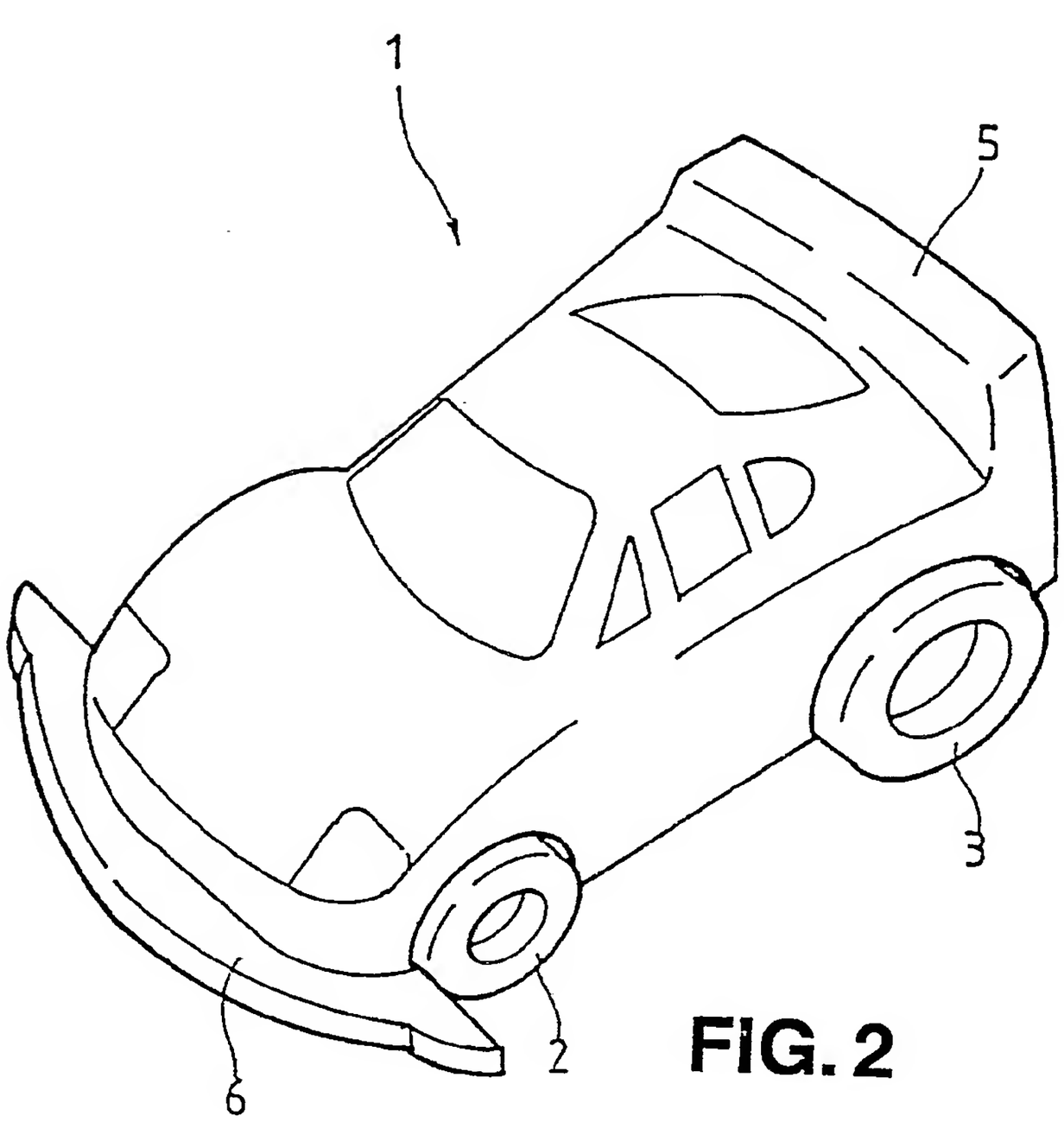

FIG. 2

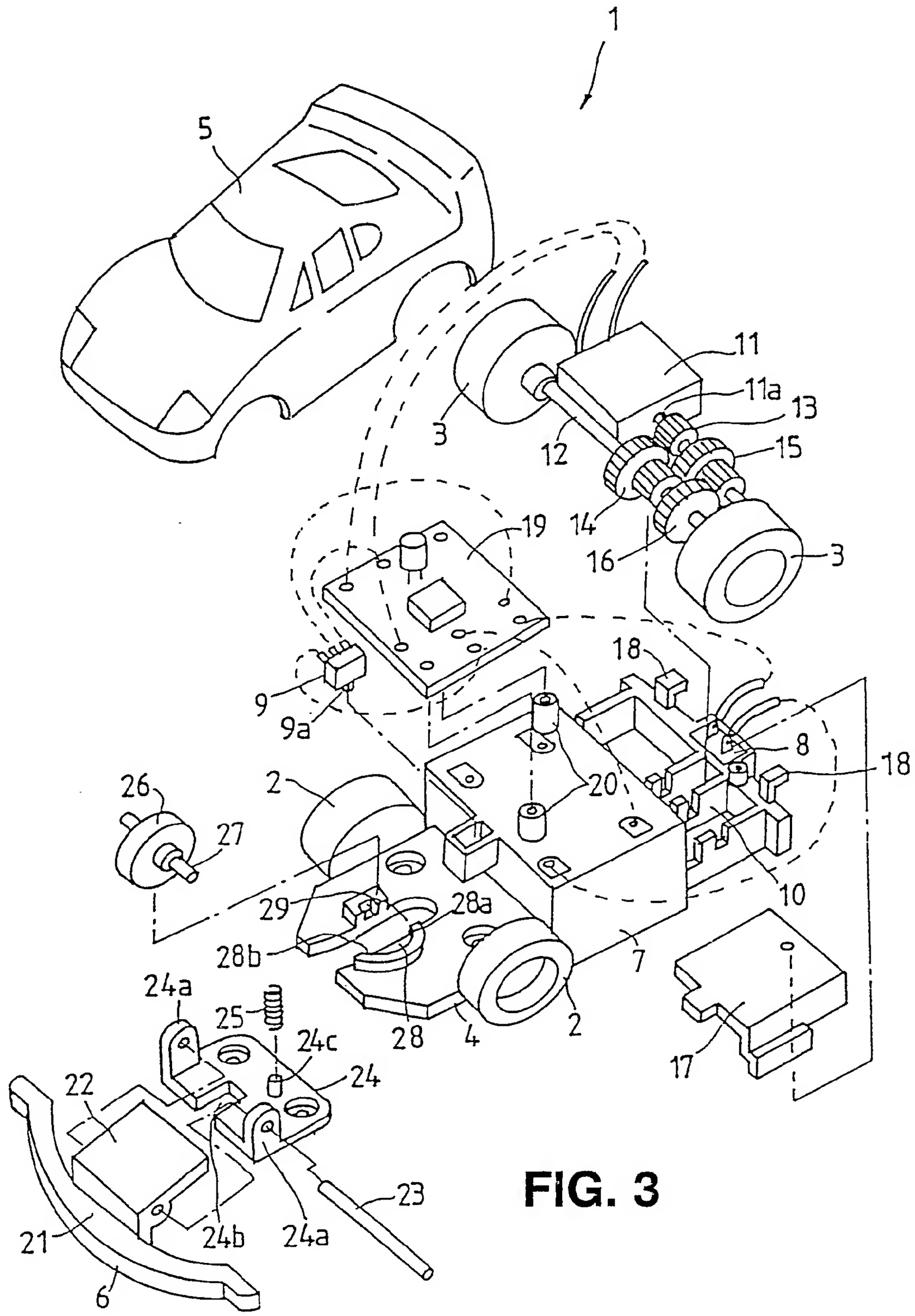
1
5
3
11
11a
13
12
15
14
16
3
19
18
9
9a
8
18
2
20
26
27
10
29
28a
28b
7
24a
25
24c
24
28
4
2
17
22
23
21
24b
24a
6

FIG. 3

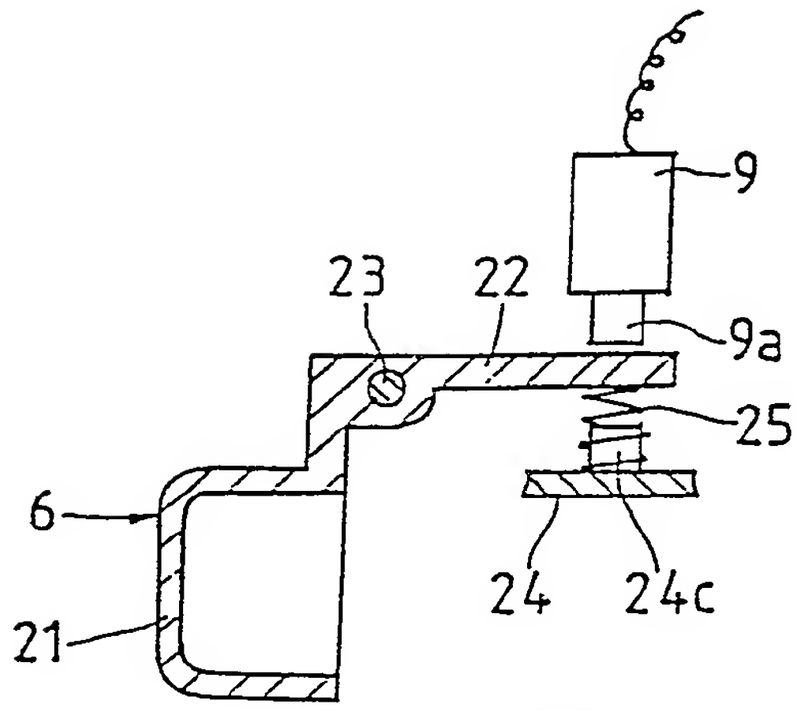

FIG. 4 A

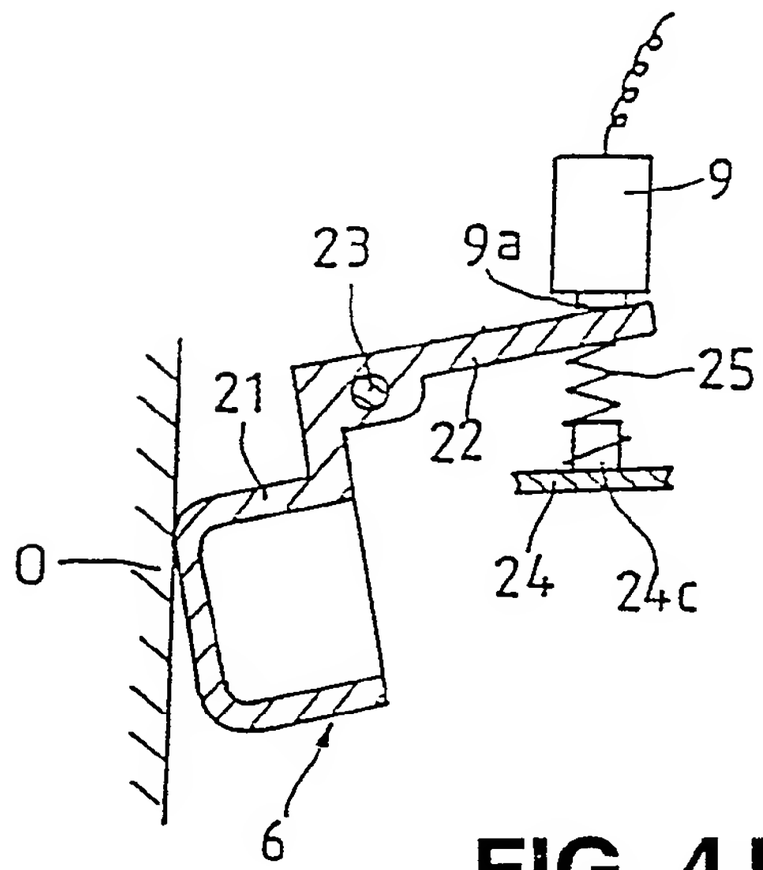

FIG. 4 B

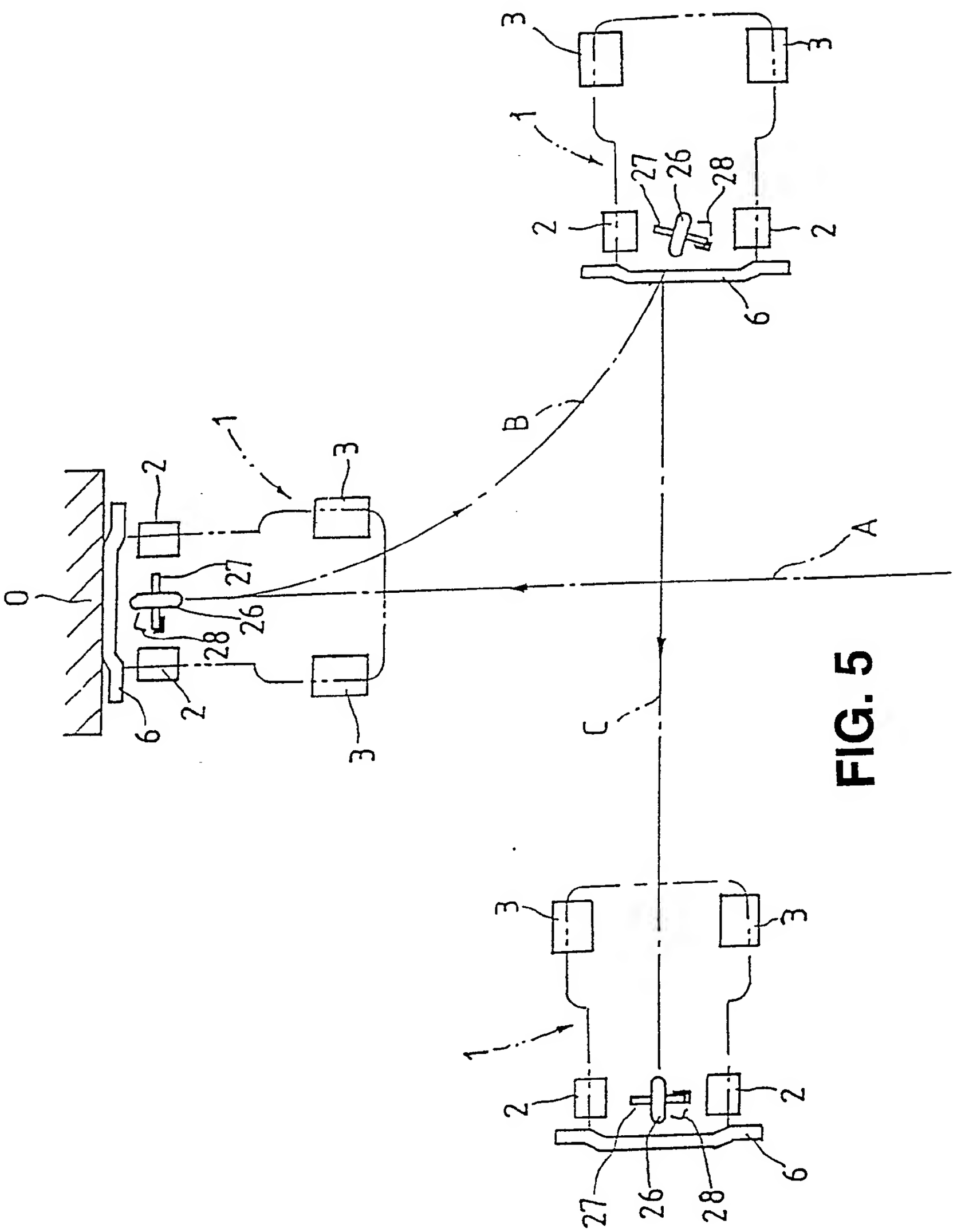

FIG. 5

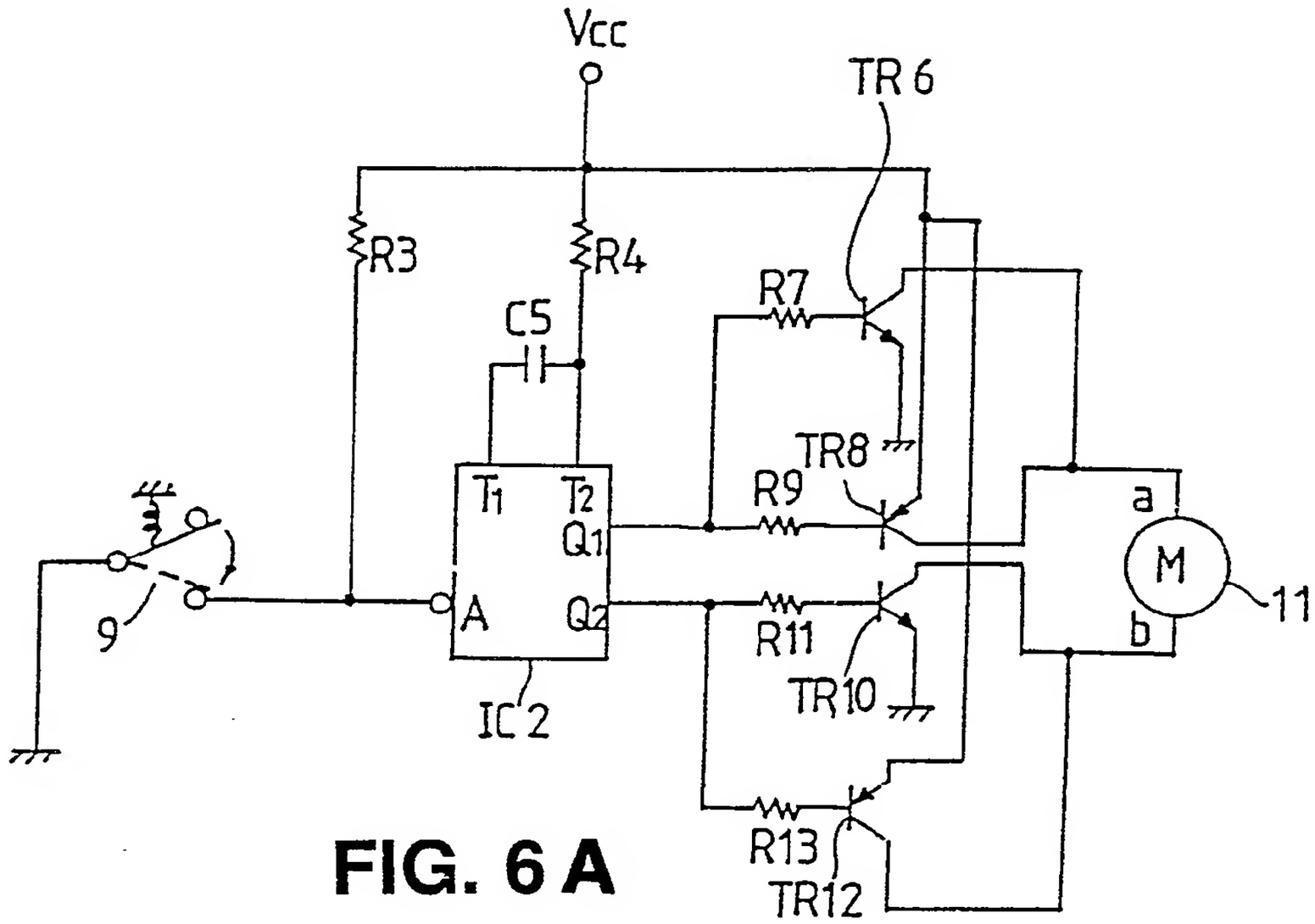
Vcc
TR6
R3
R4
R7
C5
TR8
R9
T1
T2
Q1
A
Q2
a
M
b
11
9
R11
TR10
IC2
R13
TR12

FIG. 6 A

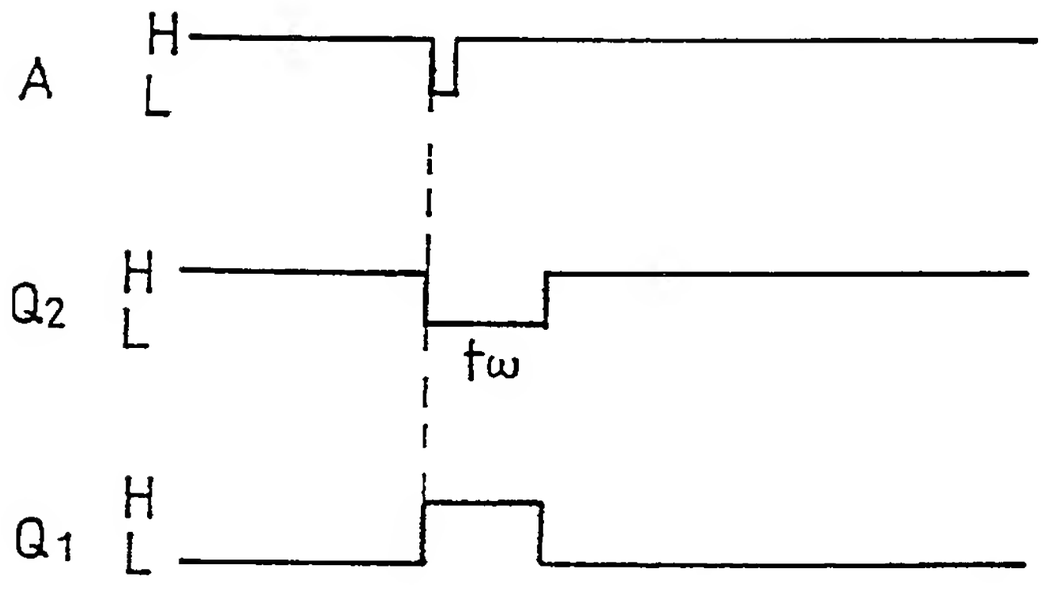
A
H
L
Q2
H
L
tω
Q1
H
L

FIG. 6 B

DESCRIPTION

TOY CAR

The present invention relates to a toy car which, after colliding with an obstacle, moves backwardly from the obstacle while turning and thereafter resumes its forward movement, thereby skillfully maneuvering around the obstacle.

A conventional toy vehicle provided with a mechanism for manoeuvering around obstacles is shown schematically in bottom view in Fig.1 of the drawings. A large disk 62 is rotatably mounted on a chassis 61. A pair of driving wheels 63 are mounted to the disk 62. A crown gear 65 is secured to a shaft 64 of the driving wheels 63 and meshes with a pinion 66 which is rotated by a motor (not shown). The motor is adapted to rotate in one direction, and responsively the pinion 66 and the crown gear 65 are also rotated in the one direction, whereby the toy car is driven to advance in a direction indicated by the solid arrow in Fig. 1. Since the crown gear 65 is mounted to a rotatable disk 62 through the shaft 64 of the driving wheels 63, the pinion 66 and the crown gear 65 are in the relationship of a sun gear and a planet gear. Therefore, the rotating force of the pinion 66 acts as a force for the crown gear 65 to rotate on its axis when the crown gear 65 does not present any rotational resistance while it acts as a force to revolve the crown gear 65 when there is even a small amount of rotational resistance.

When the crown gear 65 on the planet gear side revolves around the pinion 66 on the sun gear side, both the driving wheels 63 rotate to cause unstable steering of the toy car during forward movement. The disk 62 is therefore provided with a spring 67 with a weak urging force which has one end thereof fixed on the chassis 61 in order to cancel this rotating or revolving force.

When the toy car of Fig. 1 collides with an obstacle, the driving wheels 63 are stopped by friction with the surface of the road. That is, the rotation of the crown gear 65 is stopped. This causes the rotating force of the pinion 66 to act as a force to revolve the crown gear 65. This revolution of the crown gear 65 results in rotating both of the driving wheels 63 mounted to the disk 62, whereby the driving wheels 63 are rotated until this rotating force is balanced with the urging force of the spring 67. In this event, the urging force of the spring 67 is adjusted such that the rotating angular distance of the driving wheels 63 is between 90° and 180°. The driving wheels 63 are therefore rotated, for example, up to positions indicated by the one-dot chain lines in Fig. 1. When the rotation of the driving wheels 63 are restricted, the rotating force of the pinion 66 again acts as a force for the crown gear 65 to rotate on its axis. Since the driving wheels 63 are rotated over an angular distance of more than 90°, the toy car goes back in a direction indicated by the arrow

of the two-dot chain line in Fig. 1, i.e., obliquely runs in the backward direction. When this backward run begins, the rotational resistance of the driving wheels 63 becomes smaller, and the force of the pinion 66 for revolving the driving wheels 63 is gradually changed to a force to have the crown gear 65 rotate on its axis. Then, the urging force of the spring 67 prevails over the revolving force of the pinion 66 to move the driving wheels 63 to their original position for forward movement. That is, the toy car resumes running in the forward direction. In this way, the toy car advances avoiding obstacles by repeating forward and backward movement.

In a conventional toy car employing the delicate mechanism described above, the balance between the urging force of the spring 67 and the rotating force of the pinion 67 is lost unless the friction of the driving wheels against the surface of the road is constant, resulting in extremely unstable steering of the toy car. Also, the time period and the distance of the backward movement are difficult to adjust. In general it may be said that the structure of the toy car of Fig. 1 is both complicated and easy to break.

The principal object of the present invention is to provide a toy car which is simple in structure, inexpensive to manufacture and capable of reliably

avoiding obstacles encountered when it is running along a surface.

According to the toy car of the present invention, there is provided a motor for driving the vehicle forwardly, a switch operated by the toy car when colliding with an obstacle, a controller for driving the motor to rotate in the reverse direction for a predetermined period of time in response to activation of the switch, and a steering wheel mechanism for causing the toy car to run straight when it advances and to turn when it goes back.

Preferably, the switch mechanism comprises a bumper rotatable about a shaft when the car collides with an obstacle, and a switch abutting the tail end side of the bumper and operated by rotating action of the bumper. The bumper preferably comprises a bumper body, a rotatable arm extending from the bumper body in an L-shape in cross-section, and a fulcrum arranged on the rotatable arm and offset upwardly relative to the bumper body.

In the preferred embodiment, the steering mechanism consists of a steering wheel and a wheel shaft bearing for receiving a wheel shaft of the steering wheel, wherein the wheel shaft bearing is formed in a fan shape by a first restricting end orthogonal to the center line of the toy car for restricting the rear position of the wheel shaft and a second restricting end spaced an

angular distance from the first restricting end for restricting the front position of the wheel shaft, the wheel shaft being arranged movably between the first restricting end and the second restricting end.

When the advancing toy car collides with an obstacle, the switch acts to drive the motor in the reverse direction for a predetermined time period through the controller. This reverse rotation of the motor causes the toy car to go backwardly for a predetermined time. While the toy car is going backwardly, the steering mechanism operates to turn the toy car. When the predetermined time period has elapsed from the beginning of the backward running of the toy car, the motor is restored to its normal operation rotating in the original forward direction, whereby the toy car proceeds to run in the forward direction along a straight path. In this manner, when the toy car collides with an obstacle, it retreats as it turns, runs forward, and thereafter repeats this pattern. Since this running pattern of the toy car for avoiding an obstacle is determined by a backward running time period set by the controller and a steering angle for turning the toy car set by the steering mechanism, the running pattern can be freely adjusted.

Since the switch includes as an integral part thereof a bumper vertically rotatable about a rotation shaft when the car collides with an obstacle, and a

switch operated by the rotating action of the bumper, the switching function can be performed without damaging the appearance of the toy car.

In the present invention, the wheel shaft bearing is formed in a fan-shape by the first restricting end orthogonal to the center line of the toy car for restricting the rear position of the wheel shaft and the second restricting end is spaced by an angular distance from the first restricting end for restricting the front position of the wheel shaft. The wheel shaft is freely movable between the first restricting end and the second restricting end. The wheel shaft moves backward in the wheel shaft bearing and is restricted by the first restricting end when the toy car advances, while the wheel shaft moves forward and is restricted by a turn steering position when the toy car goes backward. Since the first restricting end is orthogonal to the center line of the toy car, and the second restricting end is spaced by an angular distance from the first restricting end, the toy car is automatically set in a straight steering position and a turning steering position during forward and backward movement, respectively.

The invention will now be further described by way of example, with reference to the accompanying drawings, wherein like reference numerals refer to like parts throughout, and wherein:

Fig. 1 is a bottom plan view illustrating portions of a conventional toy car;

Fig. 2 is a perspective view illustrating the general appearance of a toy car according to an embodiment of the present invention;

Fig. 3 is an exploded perspective view of the toy car of the present invention;

Figs. 4(a) and 4(b) are cross-sectional views of the bumper and related mechanism, illustrating the action of the bumper;

Fig. 5 is an explanatory diagram illustrating the obstacle avoiding movement of the toy car of the present invention;

Fig. 6(a) is a circuit diagram of the controller circuit of the toy car; and

Fig. 6(b) is a time chart illustrating the relationship between input and output signals of the monostable multivibrator used in the circuit of Fig. 6(a).

Details of the conventional car of Fig.1 have previously been described .

A toy car according to the present invention will hereinafter be described with reference to the accompanying drawings. As shown in Figs. 2-3, the car 1 comprises a chassis to which a pair of front wheels 2 and rear wheels 3 are mounted, a body 5 mounted over the chassis, and a bumper 6 attached to the front end of the body 5. The car 1 may be constructed to resemble a sports car. The chassis is provided with a driving

system at a rear part thereof, a control system on an intermediate to front part thereof, and a steering system in the front part thereof. This car 1 is adapted to run straight ahead by a motor powered with a battery accommodated in a battery box 7 by turning on a main switch 8 arranged in the center of a rear end portion thereof.

When the car 1 collides with an obstacle O during its movement along a straight path, a sub-switch 9, later described, is turned on by the action of the bumper 6, whereby the control system including these switching mechanisms operates to control the car 1 such that it goes back for a predetermined time period (see Fig. 5). During backward running of the car 1, the steering system is automatically set to a turning position, whereby the car 1 turns while running in the backward direction. When the car resumes its forward movement, the steering system is automatically set in the straight running state, whereby the car 1 goes straight ahead. In this way, the car 1 avoids the obstacle O by repeated straight forward running, backward running and turning and straight forward running.

The internal structure of the car 1 will now be explained in detail with reference to Figs. 3 and 5. As shown in Fig. 3, a rear part of the chassis 4 includes a gear box 10 in which the driving system of the car 1 is arranged. The driving system transmits the rotation of a

motor 11 to a rear wheel shaft 12 through a variety of gears to rotate the rear wheels 3. A pinion 13 mounted to a rotating shaft 11a of the motor 11 meshes with a first intermediate gear 14 rotatably secured to the rear wheel shaft 12. The first intermediate gear 14 meshes with a second intermediate gear 15 which is rotatably mounted on the chassis 4. The second intermediate gear 15 meshes with an output gear 16 secured to the rear wheel shaft 12, whereby both the rear wheels 3 are rotated while the rotation of the motor 11 is appropriately decelerated by the first and second intermediate gears 14 and 15. The rear wheel 3 on the right side may be mounted to the rear wheel shaft 12 in a freely rotatable state while the rear wheel 3 on the left side may be secured to the rear wheel shaft 12 such that the rear wheel 3 on the left side only may be driven. In this manner, when the car 1 goes backwardly, the rear wheel 3 on the right side is in a stop state, whereby the turning radius can be reduced. Reference numeral 17 in Fig. 3 designates a cover for the gear box, and reference numeral 18 designates a pair of hooks formed on the rear end of the chassis 4 which are engaged by openings (not shown) formed in the rear end of the body 5 to thus attach the body 5 on the chassis 4.

The control system comprises a controller 19 arranged on the battery box 7 of the chassis 4 and the switch means consists of the bumper 6 and the sub-switch

9. The sub-switch 9 is operated by the bumper 6 when it collides with the obstacle O and rotates, and is accommodated in a recess formed in a central portion of the front end of the battery box 7 with its button 9a directed downwardly. The controller 19 utilizes electronic devices mounted on a substrate, and mounted to the battery box 7 through spacers 20.

The control circuit of the controller 19 will be explained in detail with reference to Figs. 6(a) and 6(b). Referring to Fig. 6(a), a monostable multivibrator IC2 has an A terminal which is a low-active input and usually held at H (high) level by a resistor R3. In this state, the output from a Q1 terminal of the IC2 is at L (low) level while the output from a Q2 terminal of the same is at H level. Therefore, since a base current (IB) flows through a PNP transistor TR8, an emitter current (IC) flows, resulting in applying a voltage to an a terminal of the motor 11. Also, when the base current (IB) flows through a PNP transistor TR10, the emitter current (IE) also flows, whereby a b terminal of the motor 11 is held at the ground level. The motor 11 is driven to rotate in the forward direction in this manner.

When the sub-switch 9 is turned on, the A terminal of the monostable multivibrator IC2 is instantaneously held at the ground level, resulting in outputting a voltage at L level from the Q2 terminal for a time period determined by a time constant tw which is defined by a

resistance value (RX) of the resistor R4 and a capacitance value (CX) of a capacitor C5 (tw=CX·RX). Simultaneously, a voltage at H level is outputted from the Q1 terminal for the time period tw (Fig. 6(b)). Then, the TR12 applies a voltage to the b terminal of the motor 11 while holding the a terminal at the ground level. In this manner, the motor 11 is driven to rotate in the reverse direction. When the time period tw has elapsed, the IC2 is recovered to the original state, and the motor 11 resumes to rotate in the forward direction. R7, R9, R11 and R13 are resistors for controlling the base current.

As described above, the control circuit drives the motor 11 in the forward direction in a normal condition and in the reverse direction for a predetermined time period when the sub-switch 9 is turned on. The time period in which the motor is driven in the reverse direction is determined by the time constant defined by the resistor R4 and the capacitor C5 constituting the control circuit. Therefore, the backward running period and hence the backward running distance of the car 1 can be readily adjusted by exchanging the resistor R4 and the capacitor C5.

The mechanism of the bumper 6 for turning the sub-switch on will now be explained with reference to Figs. 3 and 4. The bumper 6 comprises a body 21 extending from the front end of the body 5, an L-shaped rotatable arm

extending upwardly from an intermediate portion of the bumper body 21 and bent to extend backwardly, and a rotation shaft 23 extending transversely through the bent portion of the rotatable arm 22 and offset upwardly with respect to the bumper body 21. A central portion of the rear part of the rotatable arm 22 abuts the button 9a of the sub-switch 9. That is, when the bumper 6 is struck by an obstacle, the rear end of the arm 22 rotates upwardly from a normal position by the action of the lever to depress the button 9a to turn on the sub-switch 9.

The bumper 6 is rotatably mounted to a supporting member 24 by the shaft 23, and the supporting member 24 is secured to a front portion of the chassis 4 by screws. The supporting member 24 is formed with a pair of bearings 24a which have both sides of front portions erected, a notch 24b to which a steering wheel 26, later referred to, is opposed to with the intervention of both the bearings 24a in its central portion, and a protrusion 24c in an intermediate rear portion of the supporting member 24. The bumper 6 is mounted to the bearings 24a by the shaft 23, and a coil spring 25 is mounted to the protrusion 24c. The coil spring 25 has its upper end abutting the rotatable arm 22 of the bumper 6 from the downward direction to urge the rotatable arm 22 upwardly, whereby the bumper 6 is held in its normal position and

provides an additional depressing force when the bumper 6 depresses the sub-switch 9.

As shown in Fig. 4, the button 9a of the sub-switch 9 is positioned opposite the coil spring 25 through the actions of the rotatable arm 22 of the bumper 6. The sub-switch 9 is urged by the coil spring 25 through the rotatable arm 22 to an extent that it is not turned on by the urging force of the coil spring 25 (Fig. 4(a)). When the car collides with the obstacle O, the bumper 6 vertically rotates about the shaft 23 to depress the button 9a of the sub-switch 9, thereby turning on the sub-switch 9 (Fig. 4(b)). When the sub-switch 9 is turned on, the controller 19 begins operating to rotate the motor 11 in the reverse direction for a predetermined time period, whereby the car goes backward. During backward running, the steering system acts to automatically steer the car 1 from a straight path to a turning path.

As seen in Fig. 5, the steering system or mechanism includes the steering wheel 26 and a wheel shaft bearing 28 for receiving the wheel shaft 27 of the steering wheel 26. The steering wheel 26 is in contact with the surface of the ground, while the front wheels 2 are suspended above the surface of the ground. As shown in Fig. 3, the steering wheel 26 is secured to the wheel shaft 27 which is retained in the wheel shaft bearing 28 formed in the chassis 4. In a central front portion of the chassis 4

there is formed a long hole 29 extending in the longitudinal direction of the chassis 4. The wheel shaft bearing 28 is formed in a fan-shape over this long hole 29. The long hole 29 has its front, right portion curved to be more widely open, and the steering wheel 26 is located in this portion such that the car 1 can be steered to run straight and to turn to the right by the steering wheel 26.

The wheel shaft bearing 28 is formed by protruding the surface of the chassis 4 around this fan-shaped portion which is left flat. With the long hole 29 being at the center, the right side corresponds to the pivot of the fan, while the left side corresponds to the peripheral portion of the fan. More specifically, the wheel shaft bearing 28 has a first restricting end 28a orthogonal to the center line of the car for restricting the rear position of the wheel shaft 27 of the steering wheel 26 and a second restricting end 28b spaced a desired angular distance from the first restricting end 28a for restricting the front position of the wheel shaft 27, and is formed in a fan shape defined by the first and second restricting ends 28a and 28b. The steering wheel 26 is supported by the pivot portion of the wheel shaft bearing 28 at the end of the wheel shaft 27 on its right side and is also supported by the peripheral portion of the wheel shaft bearing 28 at the end of the wheel shaft 27 on its left side, whereby the wheel shaft 27 is

movable between the first restricting end 28a and the second restricting end 28b. The steering wheel 26 receives a force urging same in the backward direction when the car is running forward and receives a force urging same in the forward direction when the car is running backward. Stated another way, the wheel shaft 27 of the steering wheel 26 is pushed onto the first restricting end 28a of the wheel shaft bearing 28 when the car is running forward, and onto the second restricting end 28b when the car is running backward. Therefore, the steering wheel 26 is automatically set in a straight position during straight running of the car 1, while set in a right turning position during the backward running of the car 1. The wheel shaft bearing 28 is closed by the supporting member 24 of the bumper 6 mounted to an upper location thereof.

The various movements of the car 1 will now be explained with reference to Fig. 5. Initially, the car 1 is running in a straight path in a direction indicated by a one-dot chain line A and collides with the obstacle O. When the car 1 collides with the obstacle O, the bumper 6 is vertically rotated about the shaft 23 to turn the sub-switch 9 on. The turning-on of the sub-switch 9 causes the controller 19 to drive the motor 11 backward, whereby the car 1 goes back. When the car 1 starts going back, the steering wheel 26 is automatically set in a right turning position by the action of surface resistance,

with the result that the car 1 runs backwardly while turning to the right as indicated by a one-dot chain line B for a predetermined time period. When the predetermined time period of the backward movement has elapsed, the car 1 proceeds to move forwardly. When the car 1 starts running forwardly, the steering wheel 26 is automatically restored to the straight position, whereby the car 1 runs in the direction indicated by a one-dot chain line C. As described above and illustrated in Fig. 5, the car 1 strikes the obstacle head on and the changes of direction of movement of the car 1 are at right angles. However, this is only illustrative, and the angle may be modified by adjusting the steering angle of the steering wheel 26 by the shape of the wheel shaft bearing 28 and by adjusting the running time period of the controller 19. For example, in Fig. 5, if the rear wheel 3 on the left side only is driven and the rear wheel 3 on the right side is left free, and if the steering angle is adjusted to be relatively large, the rear wheel 3 on the left side rotates in the backward running direction, and the rear wheel 3 on the right side rotates in the forward running direction by the reaction of the rear wheel 3 on the left side after the car 1 has collided with the obstacle O. The car 1 therefore spins upon colliding with the obstacle O and subsequently runs in the direction opposite to that indicated by the one-dot chain line A.

As described above, since the bumper 6 is rotated when the car 1 collides with the obstacle O, the sub-switch 9 can be reliably turned on with a small colliding force because of the action of the lever. This is because the rotation shaft 23 is sufficiently offset from the bumper body 23 and is also offset upwardly such that the force of the car 1 to climb the obstacle O when the car 1 collides with the obstacle O can be effectively utilized. For example, even when the car 1 collides obliquely with the obstacle O, this structure will turn the sub-switch 9 on. This is also the case where the colliding direction is almost parallel to the running direction of the car 1. Therefore, the car 1, after colliding obliquely with the obstacle 1, will never stop. Also, since the avoiding angle of the car 1 can be adjusted by the steering angle of the steering wheel 26 and the backward running time period provided for by the controller 19, the adjustment is quite easy.

In the steering system of the present invention, since the wheel shaft 27 of the steering wheel 26 is set in the fan-shaped wheel shaft bearing 28, the car 1 can be automatically steered by surface resistance received by the steering wheel 26 during running, thereby enabling the car 1 to advance or retreat and turn. It is readily apparent that the present invention may be used in a radio-controlled car.

According to the present invention, when the toy car collides with an obstacle, the motor is driven in the reverse direction for a predetermined period of time by the switch mechanism such that the toy car runs backward, and a steering mechanism is used to turn the toy car, whereby a desired running pattern is provided by the combination of a reverse rotation time of the motor and the turning angle of the car, with the result that the car can reliably avoid obstacles.

Since the switch mechanism employs a bumper vertically rotatable about a rotation shaft and a switch adapted to operate by the rotation of the bumper, the toy car is not damaged during play. The toy car can reliably avoid obstacles irrespective of the shape and location of such obstacles. Further, since the fulcrum of the bumper body is upwardly offset, the operation of the switch is reliable.

The wheel shaft bearing of the steering mechanism is formed in a fan shape by a first restricting end for restricting the rear position and a second restricting end for restricting the front position, and the wheel shaft of the steering wheel is made freely movable between the first restricting end and the second restricting end, whereby the toy car can be automatically and reliably steered by a mechanism that is simple in construction.

CLAIMS

1. A toy car adapted to run in a forward direction by the normal operation of a motor mounted therein, comprising:

switch means operable when the toy car collides with an obstacle;

controller means for driving the motor in the opposite direction for a predetermined period of time in response to operation of said switch means; and

steering means for guiding the toy car along a straight path when the car is moving forward and to guide the car along a curved path when the car is moving rearward.

2. A toy car according to claim 1, wherein said switch means comprises:

a bumper vertically rotatable about a shaft when the car collides with an obstacle; and

a switch abutting said bumper and operated by the rotation of said bumper.

3. A toy car according to claim 2, wherein said bumper comprises a bumper body, a rotatable arm extending from said bumper body being L-shaped in cross-section, and a fulcrum on said rotatable arm and offset upwardly relative to said bumper body.

4. A toy car according to any one of claims 1, 2 or 3, wherein

said steering means comprises a steering wheel and a wheel shaft bearing for receiving a wheel shaft of the steering wheel, said wheel shaft bearing being formed in a fan-shape by a first restricting end orthogonal to the center line of the car for restricting the rear position of said wheel shaft and a second restricting end spaced by an angular distance from the first restricting end for restricting the front position of the wheel shaft, said wheel shaft being movable between said first restricting end and said second restricting end.

5. A toy car substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9306111.7

Relevant Technical fields

(i) UK Cl (Edition L) A6S

(ii) Int Cl (Edition 5) A63H

Search Examiner
R A H CASLING

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search
30 APRIL 1993

Documents considered relevant following a search in respect of claims 1 TO 5

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2216025 A	(GENTILE) - see page 7 lines 16-19, page 8 line 13 et seq, and page 9 line 16	Claim 1 at least
X	GB 1240781	(IDEAL TOY) -see page 1 line 41 et seq and page 3 line 25 et seq	Claim 1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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